INCIDENCE OF HIV-1 INFECTIONS AND CHANGE IN STI's AND RISK SEXAUL BEHAVIOURS IN NORTHERN TANZANIA: A LONGITUDINAL STUDY.

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1.0: ABSTRACT:

Objectives:

To determine the prevalence and incidence of Human Immunodeficiency Virus type-1(HIV-1) infections and to describe change in the prevalence of Sexually Transmitted Infections (STI's) and related risk sexual behaviours in a rural village, northeast, Tanzania.

Design: A longitudinal study involving a total village population.

Methods:

Two survey rounds were conducted in 1991 and 1993 where the whole village population was invited to participate. A total of 3249(83.6%) individuals participated in 1991 and 2191 (76.9%) participated in 1993. Following written consent, all participants were tested for HIV-1 and those aged 15-44 gave specimen for STI's and were further interviewed regarding their risk sexual behaviours.

Results:

The total prevalence of HIV-1 infections increased from 1.3% to 1.8% from 1991 to 1993. (p=0.17). Overall HIV-1 incidence in this rural population was 8.9/1000 Person-Years at Risk (PYAR), 13.0/1000 PYAR for women and 4.3/1000 PYAR for men. Relative Risk (RR) = 3.0; 95% CI: 1.12-8.16, p= 0.02). Married participants had a high incidence of HIV-1 than single participants (20.1/1000 PYAR vs. 7.0/1000 PYAR, RR=2.8; 95%CI 1.16-6.89, p=0.01). From 1991 to1993, the prevalence of gonorrhoea increased from 0.6% to 3.9% (p=0.00) with men more affected than women. In women, the prevalence of Bacterial Vaginosis (BV) rose significantly from 3.3% to 18.2% (p=0.00) and that of Vaginal candidiasis from 4.5% to 18.8% (p=0.00). Majority of respondents (98%) knew about HIV/AIDS transmission and about 90% of respondents reported having changed their risk sexual behaviours. However, 121 (38.2%) of men and 71(14.5%) of women (p=0.00) continued to involve themselves in multiple sexual liaisons with married participants at the highest risk. More men than women (6.8% vs. 2.2% in 1991, 6.6% vs. 1.1% in1993) reported to engage in casual sex during travel. The overall increase in condom use was modest.

Conclusions:

The rate of HIV-1 infections is at increase in this rural population coupled by an increase in the prevalence's of other STI's. Increase in risk sexual behaviours is the likely explanation for the increase in STI/HIV-1 infections. The acquired knowledge regarding HIV/AIDS has not been adequate to initiate desired behavioural change. More intensive HIV-1 control measures targeting high risk men and vulnerable women particularly those who are in marriages are needed.

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LIST OF ACRONYMS

AIDS	Acquired immunodeficiency Syndrome
ANC	Antenatal Clinic (Care)
BV	Bacterial Vaginosis
CSW	Commercial Sex Workers
DHS	Demographic and Health survey
EIA	Enzyme Immunoassay
ELISA	Enzyme-linked Immuno-sorbent assay
GD	Genital discharge
GUD	Genital Ulcer Disease
HIV	Human Immunodeficiency Virus
HSV_2	Herpes Simplex Virus, type 2 (genital herpes)
KCMC	Kilimanjaro Christian Medical Centre
KOH	Potassium Hydroxide
LE	Leukocytes esterase
NACP	National AIDS control programme
NAFCO	National Food and Agricultural Company
PCR	Polymerase Chain Reaction
PYAR	Person-Years at Risk
RPR	Rapid Plasma Reagin test
SPSS	Statistical Package for Social Sciences
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infection
TPC	Tanganyika Planting Company
TPHA	*Treponema Pallidum* hemaglutination test
UNAIDS	Joint United Nations Programme on HIV/AIDS
VCT	Voluntary Counselling and Testing
VDRL	Venereal Disease Research Laboratory Test
VDS	Vaginal Discharge Syndrome
WB	Western Blot
WHO	World Health Organization

DEFINITION OF TERMS

Adults: Individual aged between 15-45 years of age. For the purpose of this study, this was the sexually active segment of the population.

Asymptomatic: It's the state of absence of symptoms or signs of a disease in a a patient. The disease is only diagnosed based on laboratory tests.

Attrition/loss to follow up: Loss of sample member over time in a longitudinal and experimental research with post test.

Causal relationships: Observed changes (the effect) in one variable are owing to earlier changes in another.

Cohort: A group of population which has a common experience/characteristic (eg.birth cohort).

P-Value: p is a symbol of probability associated with the outcome of a test of a null hypothesis. (I.e. the probability that the observed inferential statistics occurred by chance)

Sensitivity: Ability of the actual gradation on the scale's to reflect the changes adequately; probability of correctly identifying affected persons (case). Ability of a test to identify positive cases compared to a goldstandered.

Specificity: a measure of the probability of correctly identifying a non-affected person (i.e. no-case) with the measure.

Validity; external the extent to which the research findings can be generalised to the wider population of interest and applied to different settings. (Generalization)

Validity; internal the extent to which the instrument is really measuring what it's supposed to measure.

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2.0: Background and review.

2.1: Global HIV/AIDS Epidemic

Within a single generation, Human Immunodeficiency Virus (HIV) infection has become the most far-reaching and damaging epidemic the world has ever seen. HIV/AIDS affect 40 million people worldwide, 5 million of them were infected in the year 2003 and 12,000 people are estimated to be infected everyday. If the current projections are correct, 100 million people will contract the disease by the end of the decade, and 45 million more people will die from AIDS-related illnesses. Sub Sahara Africa has been the most affected region, it has an estimated 26.6 million people infected, and AIDS killed approximately 2.3 million people in the year 2003 alone.[1]

2.2: Local HIV/AIDS epidemic.

Tanzania is among the countries in Sub-Saharan Africa severely affected by HIV/AIDS, where 2.4 million people are estimated to be infected with HIV/AIDS.[2] Based on ANC surveillance data, HIV prevalence have been fluctuating from site to site and in the year 2000, the prevalence ranged from 4.2% to 32.1%. The highest prevalence was observed in age group 14-24 years and 25-34years. The high prevalence rate in the age group 14-24 years is an indicator of high incidence of HIV infection in the respective surveillance communities.

The prevalence of HIV infection among blood donors have been raising, where from 1991 to 2000, the prevalence of HIV infection among males increased from 5.8% to 9.2%. The corresponding prevalence among females rose from 7.2% to 13.3% from 1991 to 2000.[2]

Different general population studies have reported variations in the HIV infection rates in different places in the country. A longitudinal study in Mwanza,[3] reported the prevalence of HIV among adults aged 15-44 years to be increasing gradually from 5.9% in 1994-1995 to 6.6% in 1996-1997 and 8.1% in 1999-2000. The incidence of HIV infection increased from 0.8 to 1.3 per100 person-year during 1994-1997 and 1999-2000 respectively. This increase in HIV prevalence and incidence in the general population

have also been observed elsewhere in Africa despite ongoing effort to arrest the epidemic.[4]

A study involving a cohort of police officers in Dar es Salaam[5] reported a prevalence of 13.8% at recruitment and the overall incidence was 19.9/1000 Person Years at Risk (PYAR) while another cohort of factory workers in Mwanza [6] reviled a prevalence of 10.8% and 15.3% among males and females respectively. The overall incidence in this cohort was 10/1000PYAR despite the fact that this factory population has good access to Sexually Transmitted Diseases (STD) treatment, HIV prevention education and condom supply. In Arusha urban ward[7], the prevalence of HIV infection was found to be 3.7% and 11.6% among male and females back in 1994, while in Arusha townships at that time it was 0.9% and 5.1% and in rural villages it was 0.9% and 1.8% among males and female respectively.

Although there has been some claim that the prevalence of HIV infections might be decreasing, only one population based follow-up study to our knowledge have reported a decline in HIV prevalence in Tanzania similar to what has been observed in the countries of Zambia [8] and Uganda.[9]

The HIV prevalence decrease from 24.2% to 18.3% in Bukoba urban from 1987 to 1993 and the corresponding decline in Bukoba rural in women aged 15-24 years was 9.7% to 3.1% respectively[10]. Other age groups in rural areas showed no change in prevalence. Bearing in mind that Bukoba is the region where the first AIDS cases were reported in the country back in 1983, the epidemic is mature, hence changes in background differential inclusion, such as HIV-related morbidity and mortality, may have influenced the results.[9, 11]

The prevalence of HIV infection is extremely high in high risk groups like STD clinic attendees, commercial sex workers (CSW) and bar and hotel workers. In an STD clinic study[12] in two urban areas of Dar es Salaam and Mbeya, the prevalence of HIV infection among people with Genital Ulcer Disease (GUD) was reported to be 46% and 52% in Dar es Salaam and Mbeya respectively; among the non-GUD patients, the corresponding rates were 35% and 45% respectively. Another study[13] in Moshi, involving female bar and hotel workers, reported a prevalence rate of 26.3% in 2002.

In an open cohort[14] of 600 female bar workers in Mbeya, the HIV prevalence rate was found to be 68%, and as this core group is known to engage in multiple sexual liaisons, the contribution to HIV transmission might be very high in the respective surrounding communities. Studies involving high risk groups in sub Saharan Africa [15, 16] have also reported high prevalence rates; notably a study in Kisumu[16] which reported the prevalence among commercial sex workers to be as high as 75%.

From these studies, its evident that there is a wide spread variation in the prevalence of HIV infection based on location and type of study population. This indicates that great variation do also exist in the specific factors governing the spread of the infection in different locations and population groups in the country.

2.3: HIV / AIDS situation in Kilimanjaro Region.

Kilimanjaro region has been described to be one of the high-risk transmission areas [17] due to its location close to the boarder with neighbouring country of Kenya, presence of highway to the nearby countries as well as the presence of Mount Kilimanjaro. High level of business activities within the region and with neighbouring country and tourist activity of mountain climbing brings many people together, resulting in sexual networking and hence HIV transmission.

Cumulative AIDS cases in Kilimanjaro region has been increasing from 5513 in 1995 to 8,088 in the year 2000, ranked the fourth affected region in the country. [2] Because the cumulative number of reported AIDS cases has been estimated to represent only one-fifth of all actual AIDS cases [18,] the actual number of cases in the region was likely to be in the order of 40,000 cases by the year 2000.

One early population based study [19] involving a whole village in Moshi rural district in 1991 showed an overall HIV prevalence of 3.7% with women aged 25-29 years of age registering the highest prevalence of 8.7%.

Based on ANC data in Moshi rural site, HIV prevalence seems to have increased from 4% in 1997 to 20% in 2001.

A cross sectional study[20] of 382 women attending primary health care clinics in Moshi, reported a prevalence of 11.5% indicating that the rate of HIV infection is high even in this groups considered to be at relatively low risk of HIV infection.

2.4: Drawbacks in Current HIV/AIDS monitoring systems

The UNAIDS [1] recommends that every country needs to have in place an effective and efficient system of HIV surveillance and the most common measure of the HIV/AIDS epidemic is the prevalence of HIV infection in a country's adult population. But prevalence rate offers unclear picture [11] of resent trends in the epidemic because it does not distinguish between peoples who acquired the virus recently and those who were infected a decade or more years ago, is also affected by incidence, mortality and migration. Hence extreme caution must be taken in interpreting serial prevalence data's from the population or sentinel subgroups, particularly in the setting of a mature epidemic characterised by high mortality or where economic or social conditions results in substantial population mobility.

Two countries could have the same HIV prevalence but be experiencing very different epidemics. Differentiating these cases would obviously have a huge impact on the kind of intervention and care efforts that are needed.

Various approaches have been used to monitor HIV trends in different countries. Antenatal Clinic (ANC) attendees, patients with sexually transmitted diseases (STD) and sex workers have been the mostly common studied groups [12-16,20] However, HIV is associated with lower fertility both directly and indirectly, so ANC sources tend to underestimate HIV prevalence due to selective HIV testing and differential use of antenatal services , drawing distorted picture of the current dynamic of the HIV epidemic.[8, 21] ANC attendees may be more health conscious and also differ in structure with the general population resulting in to locality, education, socio-economic status, age and sex specific HIV estimates.[22] It has been concluded by some authors [23, 24] that stable or decreasing HIV seroprevalence, as assessed by sentinel surveys ,is not evidence of a controlled or even a static epidemic.

Clients form STD clinic will tend to overestimates HIV prevalence because of their high-risk sexual behaviours.

Tanzania National AIDS Control Programme (NACP) major goal is to monitor HIV trends in the country, but this has largely been based on ANC surveillance data, which has inherent potential for biases.

2.5: HIV transmission factors.

HIV transmission has been described in many studies to be associated with demographic factors (age, sex, location), behavioural factors (unprotected sexual intercourse, multiple sexual partners, male circumcision, alcohol abuse and HIV/AIDS awareness, travelling) and biological factors (STI's). [1-7, 9-16. 19]

2.5.1: Demographic factors

In Africa, women are 1.2 times more likely to be infected with HIV than men while at the age group 15-24, women are 4-6 times as likely to be infected with HIV as their male counterparts.[1] Population based studies in Mwanza, Kagera, Arusha and Moshi have showed that, women 15- 30 years of age are more infected with HIV than other groups [3, 7, 9, 10, 13-15, 19]

The age of sexual debut is usually lower in women than in boys and women are married earlier than men. A survey in rural Tanzania involving 1,117 adults aged 15-54 years reported that 50% of women and 46% of men had sexual intercourse for the first time before age 16 and on average, women married 2 years and men 6 years after their sexual debut. Due to gender inequality, women have low negotiating power in the context of sex and reproduction rendering them vulnerable to HIV infection. [25]

2.5.2: Behavioural factors

2.5.2.1: *Alcohol Consumption.*

Alcohol use is associated with lower sexual inhibition, impairing judgment, diminishing personal control and perception of risk from unprotected sex and increase contact with commercial sex workers in bars and clubs[13]. Furthermore, moderate alcohol consumption might facilitate HIV transmission by increasing sexual activity and the

desire for multiple sexual partners. This is more common in mobile male population and in the rural areas, men are more likely to abuse alcohol and involve themselves in risk sexual behaviour than women.[26]

In a female bar and hotel worker study in Moshi, it was observed that greater frequency of alcohol consumption was associated with increased risk of HIV infection.[13]

2.5.2.2: Multiple sexual partners.

Sexual risk behaviour like unprotected sexual intercourse and multiple sexual partners have been described as the cornerstone for HIV transmission and that change in these behaviours is associated with reduction in the transmission rate of HIV infection[9, 10, 26-29]

Male migration due to economic and political situation in a number of African countries is resulting in high rates of partner exchange[26]. Transient men may have sex with commercial sex workers or with multiple risk partners, bringing STD's, including HIV, home to their families.

The 1996 Tanzania Demographic Health Survey (TDHS)[30] reports revealed that, out of the 8,120 men and 2256 women interviewed, 21.3% and 5.2% of men and women respectively had non-regular sexual partners. Among these respondents, 44.7% of men and 75.3% of women reported having exchanged money for sex during the last encounter; while 48.4% of men and 35.9% of women had had a sexual encounter on the first day they met their partners. Furthermore, among both married and unmarried respondents, men were more likely to report multiple sexual partners than women. Overall, 7.7% of women and 28.8% of men were engaging in multiple sexual encounters showing that the rate of sexual networking is high in the country hence playing a major role in the spread of HIV infection. The considerable drop in HIV infection in Uganda[31] is thought to be due to decrease in casual sexual liaisons rather than condom use, indicating that interventions aimed at reducing extramarital sex with multiple high-risk partners may substantially limit the potential for the spread of HIV infection in sub Saharan Africa.[26]

2.5.2.3: Condom use.

In Tanzania the rate of condom use have been found to be low [30, 32]. The report from TDHS[30] showed that, although more than 97% of the respondents were aware of AIDS; only 42% of women and 57% of men spontaneously mentioned condom use as AIDS preventive measure. Furthermore, only 4% of women and 15% of men reported having used condoms during their last sexual encounter[30].

Findings from a study[25] in northwest, Tanzania showed that 50% of the men and 15% of women reported having casual sex during the previous year, and only 20% of men and 3% of the women in this study had ever used a condom. The use was not reported as regular. In a bar workers study in Moshi, only 12.8% of participants reported to have used condom consistently and 59.1% had never used condom[13] While in the STD clinic study in the two cities in Tanzania, only 6% of the 102 participants reported using condom consistently.[12]

2.5.2.4: HIV-risk perception.

Perception of ones risk of HIV infection is an important factor for individual's HIV prevention. Risk perception does correlate with self-reported behaviours. The link between risk perception and behaviour depends on actual risk, with those persons facing higher risk being those most likely to underestimate their risk or to fail to act on it.

The TDHS[30] indicated that, 27% of women and 39% of men interviewed perceived themselves as not at risk of getting HIV/AIDS. These indicate that a substantial number of sexually active people may probably unprotected sex due to their unwarranted optimism, putting themselves at danger of acquiring the deadly infection.

In a VCT [33] centre study in Ethiopia involving 751 factory workers, the rate of condom use was as low as 1%, but only 1% of each gender said that there was a slight chance that their HIV test result would be positive.

In a female bar workers study [13], only 8% of all interviewed women perceived themselves to be at high risk of contracting HIV infection indicating that even those known to be at risk do not recognise their vulnerable position. In rural areas in Tanzania,

most people think that HIV is a disease of prostitutes and bar workers and affect people in the cities, and that they are at no risk of being infected.
This misconception has a greater impact on their behaviours and ultimately HIV transmission.
The importance of risk perception is the idea that inappropriate attitude towards health risks can make the better prevention policy useless.

2.5.2.5: Male circumcision.

There is a growing body of evidence regarding the protective effect of male circumcision in HIV transmission. A study[34] of serodiscodant couples in Uganda found an HIV incidence of 16.7 per 100 person-years among 137 uncircumcised male partners, whereas there were no seroconventions among 50 circumcised male partners ($p < 0.001$).

The geographical variation in the prevalence of HIV/STD's between islands and rural mainland community in Mwanza has been partly explained by the high prevalence of male circumcision in the islands.[35]

2.5.2.6: HIV/AIDS knowledge.

Knowledge about how HIV is transmitted and how to avoid contracting the disease is a precursor to behavioural change. Efforts have been made in many countries to improve the level of individual and community knowledge regarding HIV and its transmission. According to UNAIDS[1], basic knowledge of HIV/AIDS has increased among young people in recent years, though it's still disturbingly low in some communities, especially among young women

In Tanzania, it's reported that;[30, 32] more than 90% of men and women are knowledgeable about HIV/AIDS, 50% of them knew someone with HIV/AIDS.
Study involving primary school children in Dar es Salaam[36] showed that, 85% of pupils knew that having sex is the way of transmitting the HIV virus and 65% indicated that using a condom will help from getting infected.
HIV/AIDS related knowledge was also reported to be high in the bar and hotel worker study in northeast Tanzania[37] where, more than 90% of the participants knew that it was

possible for a healthy looking person to have HIV while about 68% knew they can avoid AIDS by using condoms.

However, the relationship between knowledge, attitude and practice is not linear, therefore the level of knowledge does not equate to better practice regarding HIV prevention.

2.5.2.7: Human migration/travelling.

Human migrations have been the main source of epidemics throughout recorded history.[38] In recent years, opportunities for disease spread have become even more numerous, reflecting the increasing volume, scope, and speed of traffic in an increasingly mobile world. HIV infection took advantage of high levels of mobility a relatively short time frame to become a worldwide epidemic. Migrations in Africa due to economic and political reasons play a major role in the spread of the epidemic in many part of the region.

Travels to areas where rates of infection are high are known to be associated with HIV seropositivity. Studies in Senegal[39] and Mwanza,[40] Tanzania found that internal seasonal and economical migration was associated with high rates of HIV-1 infection. In rural Uganda, [41] change of residence was strongly associated with an increased risk of HIV-1 infection. Reported high seroprevalence along tracking routes of East and central Africa strongly suggest that mobility and temporary stops by drivers potentiated spread of HIV-1 infection along these routes which latter diffused in to the countryside.

2.6: Risk behaviour change and HIV infection.

Lack of an effective HIV vaccine means that prevention through promotion of behavioural change remains to be the most important available strategy to reduce new HIV infection in the community. Effective HIV prevention programmes need to include behavioural interventions that target identified groups at increased risk, as well as the general population.

Behavioural interventions aims at reducing behaviour that makes individuals more vulnerable of becoming infected or infecting others with HIV and have generally advocated increased use of condom or reduction of number of sexual partners.

Sexual behaviours is not a static phenomenon, but is influenced by many factors including characteristic of an individual as well as their social and economic context. Thus, while the aim of behaviour intervention is simple, the circumstances in which they operate often necessitate their being complex and multi-dimensional where various methods focusing on the individual, the community and society have to be employed. Behaviour change has been found to mitigate the impact of HIV infection in many studies.[9, 10, 26-29]

Substantial behavioural change has occurred globally, particularly among people near one of the many epicentres of the HIV epidemic. Thailand and Uganda have been models among less-developed nations, and the Netherlands and Australia among more-developed countries.

Everywhere when appropriate programmes have been implemented, people have moved towards safer sex and incidences of STD and HIV have fallen. Such progress seems to work best when AIDS awareness is linked with something tangible like treatment and condom supply, and when people are knowledgeable regarding HIV/AIDS.[42]

Socio-demographic factors like sex, education level and age are also facilitating behavioural change.

Studies in Kagera [10] and Rakai,[27-29] Uganda have showed the increase in positive behavioural change among women of reproductive age, leading to decreased HIV/STD incidence among them.

Voluntary Counselling and Testing (VCT) have been found[43, 44] to be associated with positive behavioural change, and counselling with or without testing has been described to play a beneficial role in prevention and care.

HIV testing is usually associated with anxiety and intense emotions, which may lead in to positive behaviour. Although these emotions diminishes over time, when relevant skills to increase safer behaviours are offered, individuals who practiced risk sexual behaviour before may maintain positive behaviour preventing further spread of HIV infection. Agony and suffering resulting from AIDS death in the community have also been mentioned to induce behavioural changes in areas hit hard by the epidemic.

The predominant mode of acquiring HIV infections in Tanzania have been reported to be heterosexual (82.7%) followed by mother to child transmission (5.6%) and blood

transfusion (1.1%). [2] With heterosexual sexual encounter being the leading cause of transmission, measures targeting behavioural change are more likely to have a greater impact on HIV prevention in the country.

2.7: STI's situation in Tanzania

The global burden of curable Sexually Transmitted Infections(STI) is enormous with estimated total of more than 300 million new cases of syphilis, Human Simplex Virus type 2 (HSV-2) , gonorrhoea, Chlamydia and Trichomoniasis each year.[45] Of all these episodes, 150 million, occurs in sub-Saharan Africa.

STD's continue to be a major public health problem in Tanzania potentiating HIV transmission, as well as causing social and economic sequelae. It's estimated that about 10% of people attending urban health centres and 7% of those attending rural health centres are infected with curable STI's.

New STI's episodes are on the raise where a total of 149,222 new episodes of STI's were reported in the year 2000 compared with 39,385 episodes in 1999.[2] The age group 20-29 years had the highest prevalence of STI's where genital discharge syndrome remained the most common form of STI with females being more affected than males. The massive increase in cases is astonishing and might be due to the true increase in cases or as a result of improved surveillance system during this period.

As these data's are based on syndromic approaches where specific microbial etiological agents are not established, it's difficult to ascertain the specific STI's associated with these syndromes. Reliable data's on etiological causes of STI's are not available in the country. STI surveillance system, which was established in 1989 within the NACP, is not effective as the HIV surveillance system and the data available are case reports of people attended health facilities with STI symptoms.

However, in a facility-based study[20] in Moshi, involving women, the prevalence of HSV–2 was as high as 39%, that of bacterial vaginosis was 34%, 21% trichomoniasis and 3.2% gonorrhea/chlamydia cervicitis while genital ulcer was present in 4.4% of women. In the Mwanza cohort[46], the prevalence of genital ulcers was found to be 10.1%

and that of genital discharge was 11.7%. Active syphilis was reported in 7.1% of the individuals.

A study in Moshi[19] showed the prevalence of syphilis to be 9.3%, *Trichomonas Vaginalis* vaginitis 24.7%, chlamydia 0.8% in females and 0.4% in males and that of bacterial vaginosis to be 4.8%.

The STD prevalence,s are alarmingly higher in risk groups. A study[13] involving female bar and hotel workers in Moshi reported a prevalence of HSV-2 to be as high as 52.3%, that of bacterial vaginosis was 26.1%, while the prevalence *Chlamydia trachomatis* and *Ttrichomonas vaginalis* was 10.0% and 20.5% respectively. In a cohort of female bar workers in Mbeya, the prevalence of active syphilis was 9%, HSV2 87%; Chlamydia 12%; gonorrhoea 22%; trichomonas vaginalis 24% and bacterial vaginosis 40%. Other studies involving high risk groups elsewhere have reported the same results.[47, 48]

The World Health Organization (WHO) has placed the emphasis on the syndromic approach[49] for case measurement and management particularly in high prevalent areas having inadequate laboratory facilities, trained staff and transport facilities.

However the syndomic approach does not address the issue of sub-clinical or asymptomatic STI's or poor treatment seeking behaviour of persons with STI symptoms. Lack of adequate and appropriate management of symptomatic individuals at health centres and dispensaries remains a serious problem in most poor countries.

A study to evaluate the performance of syndomic management in India [47] showed that, syndromic management based on Vaginal Discharge Syndrome (VDS) missed about 30-40% cases of Chlamydia or gonococcal infection, and it lead to treatment in the absence of infection of Chlamydia in about 90% and gonococcal in 80% cases of VDS. Among those having no infection, 45-50% were labelled as having infection and treated for VDS.

Though specificity of Genital Ulcer Syndrome (GUS) was high, syndromic management based on GUS missed about 85% of cases having active infection and lead to treatment of ulcers in 43% of cases in the absence of syphilis infection. Such situation leads to an

obvious financial burden of un-indicated treatment and deprives asymptomatic cases of treatment.

Hence, in order to design appropriate syndromic treatment guidelines, knowledge about the aetiology of symptoms of STI's is essential and further work on prevalence-based screening studies is necessary to evaluate the performance of local syndromic management guidelines.

2.8: STIs as biological co-factor.

Both epidemiological and biological studies suggest that STIs facilitates the sexual spread of the HIV-1 infection. STIs and HIV-1 have a complex reciprocal relationship described as "epidemiological synergy" whereby STIs increases infectiousness to HIV infected individuals and increases susceptibility to uninfected one's.[50]

Table 1: Factors responsible for increasing either susceptibility to HIV or for increasing HIV infectiousness in patients with STIs

1. Share same high-risk behaviour (i.e. multiple partners, lack of condom use, high risk partners, etc.)
2. Disruption of epithelial/mucosal barriers by specific STIs.
3. Recruitment of HIV susceptible/ HIV-infected cells in the genital tract as part of the host immune response to an STI.
4. Stimulation/activation of CD4+ cells in response to an STI resulting in increased HIV viral replication.
5. STI-induced immunosuppression resulting in increased susceptibility or increased HIV viral shedding.
6. Presence of cervical ectopy or cervicitis due to STI's resulting in increased HIV viral shedding.

Source: Quinn T, 1996[51]

The association appears to be especially strong for genital ulcer Diseases (GUD) with a 2-4 fold increased rate of HIV-1 acquisition in their presence.[52-54]

In turn people with STI's are more likely to transmit HIV, because HIV has been recovered by viral culture and detected by Polymerase Chain Reaction (PCR) from chancroidal and herpetic ulceration[55, 56]

Non-ulcerative STI's have also been found to facilitate HIV transmission by microscopic disruption of the mucosal barrier, some degree of inflammation, which

increases number of HIV target cells in the genital mucosal as well as interacting with other cells at the molecular level to facilitate HIV transmission[51]. *Chlamydia trachomatis* has been shown to enhance HIV replication in the presence of Polymophonuclear cells in vitro, possibly through generation of reactive oxygen products.[50]

Non- ulcerative STI's are by far more prevalent than ulcerative types; hence their attributable contribution to HIV transmission could be extremely significant.

A study in Kinshasa [57] have reported significantly increased risk of HIV acquisition among women with chlamydia infection and trichomoniasis, while another study in Thailand [58] among commercial sex workers with chlamydia infection, revealed a significant increase in HIV acquisitions after adjusting for other risk factors in multivariate analysis.

Bacterial Vaginosis results in abnormal vaginal flora and this could increase risk of HIV acquisition in a number of ways;

First, Hydrogen peroxide (H_2O_2) produced by lactobacilli plays an important role as natural microbicide within the vaginal ecosystem and is toxic to a number of organisms including HIV. Hence, reduced concentration of H_2O_2-producing lactobacilli could facilitate HIV transmission. Second, low vaginal pH has been postulated to inhibit $CD4^+$ Lymphocytes activation resulting in reduced number of HIV target cells in the vagina. Thirdly, Bacterial vaginosis have been shown to increase susceptibility to HIV by increasing the level of endocervical interleukin-10, and by producing substances that stimulates lymphocytes and alter the effectiveness of the genital tract's mucosal immune system.[50, 59, 60]

Studies have showed that not only active STI's are associated with HIV acquisition but also a previous history of STI may be a risk factor for HIV transmission. A study [61] involving homosexual men in Barcelona showed that the risk of acquiring HIV was eight times higher among homosexual men with a previous history of STI, compared to those without a previous history of STI.

As the transmission of HIV-1 in sub Saharan Africa occurs predominantly through heterosexual intercourse, STI's can greatly potentiate its transmission. STI treatments reduce viral shedding and play an important part in reducing HIV-1

transmission. A population based randomized trial of STI treatment for HIV transmission control in Mwanza, Tanzania have proved to be effective in mitigating the transmission of HIV infection in the community, where in 2 years of improved syndromic management of STI's , approximately 40% reduction in HIV incidence was observed in intervention community compared to non-intervention communities.[62] However, there has been a discussio ns regarding the methodology of the Mwanza study comparing with that of rakai in Uganda which did not show reduction in HIV infection in the intervention group.

3.0: NUFU-FUNDED PROJECT. - KAHE PROJECT (Background)

The Kahe Project was first part of the Tanzanian-Norwegian AIDS Project (1990-1995) and later part of the NUFU-funded Project. Oria was chosen as a village for surveys and intervention where a series of population-based HIV/AIDS epidemiological and socio-anthropological studies have been carried out in 1991 and 1993. The response rates were 83.7% and 76.9% in 1991 and 1993 respectively.

The project has so far collected a large amount of data aimed at addressing a series of objectives developed at each study phase. Some findings from the project (mostly those from 1991 survey) have been disseminated through various avenues including conferences, seminars and publications. Research capacity building at various levels has also been a major component of the project.

4.0: PROBLEM STATEMENT AND RATIONALE.

Available data indicates that the prevalence of HIV infections is high and varies with location and population in Tanzania, and in terms of magnitude Kilimanjaro [1-3, 5-7, 12-14, 18-20] regions ranked the fourth in the country with Moshi rural reporting substantial increase in HIV infection in the year 2001.

Sex and age specific susceptibility for HIV transmission is still pronounced in the country where young women are at 4-6 times increased risk of being HIV infected than men of the same age.[1, 3, 7, 10, 12, 19]

Substantial number of people especially men continue to involve themselves in high-risk multiple [2, 17, 26, 30] sexual liaisons while the rate of condom use remains low. [6, 13, 14, 25, 30]

Despite people being knowledgeable about HIV/AIDS, [1, 30, 32, 36, 37] they perceive themselves to be at no or low risk of infection especially in the rural areas. [14, 25, 33]
The absence of an effective HIV vaccine means that prevention through promotion of behavioural change remains the most important available strategy to reduce new HIV infection in the community. The extent and direction of this change is unknown in most places in the country.

A number of factors such as exposure to VCT, [39,40] level of knowledge about HIV/STI, demographic factors, exposure to interventions linked with something tangible and the agony associated with high levels of death due to AIDS in the community are believed to promote behavioural change. However, these factors differ among individuals and communities. Therefore, the specific factors operating in various rural and urban communities in Tanzania are yet to be categorized.
Although there is preliminary indication that access to HIV/AIDS information and condom distribution has improved, there is no empirical evidence to show that these changes have resulted in reduced high risk sexual behaviours and increased condom use.

The prevalence of STI's has been documented to be high in the areas where STI treatment is less accessible, many people do not seek treatment, a number of STI's are not appropriately treated, and compliance to treatment is poor. [2, 12, 14, 19, 20, 41, 43, 48] With the described "epidemiological synergism"[46] between HIV and STI's, the contribution of STI's in HIV transmission in the country might be very high. Control of STI's in the community reduces HIV susceptibility and infectiousness and this has been proved by randomized controlled trial to arrest the incidence of HIV infection. [42, 54]
However we need to identify the magnitude and specific individual risk factors related to HIV/STI's transmission in order for the intervention to be directed to these factors, as well as specific STI's.

Except for a few studies,[19] most studies on HIV and STI's are hospital based or have studied high-risk groups like commercial sex workers or bar workers and they are not representative of the general population [12-14].

Many of the other available studies in Tanzania on HIV/STI's are cross sectional [5, 7, 13, 19, 20, 48] studies. These studies cannot distinguish between prevalent and incident cases. This is important in order to describe the state of the epidemic and the kind of prevention and care efforts needed.

NACP aim at monitoring the trends of HIV infection and other STI's in the country, but the available system is based on ANC surveillance data, which has much inherent potentials for bias[21-24] and might have underestimated the HIV and STI's situation in the country. Hence, they may give a distorted picture of the dynamic of the epidemic.

The STI's surveillance system is still ineffective and relying on symptomatic diagnosis missing many asymptomatic individuals and those not utilizing health facilities.

This longitudinal population based follow-up study seeks at yielding prevalence and incidence data which are of paramount importance to supplements the available ANC surveillance data and giving more analysis on various demographic, behavioural and biological factors associated with the epidemic in Oria village. These data's will also be used to estimates the magnitude and direction of bias in various present studies involving selected groups.

Appropriate description of the state of the local HIV/AIDS epidemic and factors fuelling its spread, assessing risk status and changes in risk status over time is crucial, and important step towards prescribing relevant public health measures which are more likely to limit the further spread of the epidemic.

5.0: OBJECTIVES OF THE STUDY.

5.1: MAIN OBJECTIVE.

To determine the prevalence and incidence of HIV-1 infections, and to describe the change in the prevalence of STIs and sexual risk behaviour over time in Oria village in northeast Tanzania.

5.2: SPECIFIC OBJECTIVES.

1. To determine the prevalence and incidence of HIV infections in rural Tanzania.
2. To describe change in prevalence of STI's among adults from 1991 to 1993 in rural Tanzania.
3. To determine extent and direction of risk sexual behavioural change (multiple sexual partners, condom use) among adults in rural Tanzania.
4. To assess the change in HIV/AIDS related knowledge among adults.
5. To explore the change in HIV risk perception among adults.
6. To determine the role of travelling in HIV transmission among adults.

6.0: METHODOLOGY.

6.1: Study Design: Community-based longitudinal Study.

6.2: Study Area/population:

The study was conducted in Oria village in Kahe ward, north-east Tanzania. This is a rural village located in Moshi rural district, 30 kilometres south of Moshi town, Kilimanjaro region. Moshi rural district is one of the six districts of Kilimanjaro region, others being Moshi urban, Hai, Same, Rombo and Mwanga districts. The ward is the first stop on the railway from Moshi to Dar es Salaam and the village is located only few kilometres from the Tanzanian-Kenyan border. The village had a population of 3873, according to the 1988 population census with somewhat more women than men; 51.5% versus 48.5%. The majority ethnic tribes are the Pare and Chagga, although there is a range of other ethnic groups which have migrated from all over the country and neighbouring country to work on the sisal and sugar plantations owned by the national

Food and Agricultural Company (NAFCO) and Tanganyika Planting Company (TPC). Oria village has approximately 50% Muslim population and others being Christians of different denominations. Oria is considered a low socio-economic status village purely representing the majority of the Tanzanians who live in rural areas (78% according to the 2002 population Census). Most of the villagers are peasant farmers, labourers, craftsmen and some enga ge in seasonal work at the nearby rice plantations. The village has one governmental and one private dispensary; and traditional medicine is the choice to many villa gers. Overall, the village has poor primary health services.

Fig 1: The map of Tanzania; showing the study area, Kilimanjaro Region, Northeast Tanzania

Source: *http://www.lib.utexas.edu/maps/Africa/Tanzania.gif*

6.3: Sample size and sampling.

The whole village population (N=3,873) was invited to participate in the recruitment phase in 1991.

With the help of the ten cell leaders, the whole village population was registered and effort were made to ensure both complete registration and participation even of the more mobile part of the population. The village had more women than men; 51.5% versus 48.5%. High overall participation rates, 83.7% and 76.9%, were archived in 1991 and 1993 respectively, securing that the samples were representative of this village population.

6.4: SURVEY PHASES (1991/1993).

6.4.1: Field organization

In 1991 and 1993, population based surveys were conducted in Oria village where the whole village population was invited to participate in the study.

Inclusion criteria: Eligibility was based on being a resident of Oria village. (having an address in the village).

Persons who had their home address in the village, but were away for school or work and who theoretically could come home anytime during the study period were enlisted. Of the eligible population of 3,873, 634 did not participate. Eligible participants, who did not turn up at the first appointment, were called in once or twice afterwards.

A follow up survey was conducted in 1993 where the whole village population was invited again to participate in the study. In both surveys in 1991 and 1993, the sex composition did not differ between participants and non-participants.

Participants aged 15-44 (n= 1016 in 1991 and n= 689 in 1993) were further interviewed regarding STI's, HIV/AIDS knowledge and risk behaviours and they then underwent genital examination with specimen sampling for STI's. In both surveys, participants for genital examination were significantly older than non-participants.

Before HIV testing, all participants received pre test counselling, and those who came back to receive their test results were informed by trained counsellors.

All study participants were offered free treatment for health problems present at the time of the surveys and health education was given to clear any misconceptions regarding HIV/AIDS.

6.4.2: Tests and testing strategies:

The same tests and testing strategies ware used in both 1991 and 1993 surveys.

6.4.2.1: HIV-1 testing.

Recombinant enzyme-linked immunosobernt assay (ELISA; Wellcome Diagnostics, Dartford, England) was done on collected sera. All positive or doubtful sera were tested twice with ELISA and confirmed by Western Blot (WB; Organon, Epitope, Beaverton, OR, USA).

6.4.2.2: Syphilis serological testing:

Rapid Plasma Reagin test (RPR; Syphacard-R, Murex Diagnostics Ltd., Dartford, England) and a *Treponema pallidum* hemagglutination test (TPHA, wellcosyph HA, Murex Diagnostics Ltd.) was done. If both RPR and TPHA were reactive, this was considered to be active syphilis.

6.4.2.3: **Trichomonas vaginalis testing:**

A wet mount examination of the vaginal fluid in saline was done to detect motile trichomonads. This was done on the spot during clinical examination by trained laboratory technicians.

6.4.2.4: Bacterial vaginosis:

Clue and pus cells were examined from vaginal fluids, vaginal fluids was mixed with 10% potassium hydroxide and examined for amine odour ("whiff test"), and vaginal pH was read after moisturizing a pH strip with vaginal fluids according to the manufactures instruction.

Criteria proposed by **Amsel** [63] and colleagues were followed for the diagnosis of bacterial vaginosis where presence of three of the following will be considered as bacterial vaginosis, pH > 4.5, positive “whiff test”, presence of clue cells and increased homogeneous vaginal discharge on examination.

6.4.2.5: Neisseria gonorrhoea and Chlamydia trachomatis testing:

For women urethral and endocervical swabs were obtained for the culture of Neisseria *gonorrhoea*, and endocervical swabs for Chlamydia EIA antigen testing (Wellcome Diagnostics); and for Gram-stained smear.

For men urethral swabs were taken for Gram-stained smear; *Chlamydia trachomatis* testing; and culture of *Neisseria gonorrhoea*. The charcoal swabs for detection of gonorrhoea were transported to the laboratory in Stuart's transport medium. The specimens were inoculated on New York City medium, incubated in candle extinction jar at 35 to 37 centigrade and examined daily for 3 days. Gonococcal colonies were identified by Gram-stained smears and oxidase reaction. A case of gonorrhoea was defined either by the presence of Gram negative intracellular diploccocci on Gram stained smear or positive culture, or both. Chlamydia EIA specimen's collection kits were used for transport of the sample from the study sites everyday. Chlamydia infection was detected by EIA antigen test. Test results were categorized as negative, positive or indeterminate.

6.4.2.6: Vaginal Candidiasis

The diagnosis of vaginal candidiasis (yeast vaginitis) was based on the presence of yeast mycelia in a wet mount examination of vaginal fluid in 10% potassium hydroxide.

6.4.3: Structured interviews.

Trained interviewers, on interview techniques, how to ask sensitive sexual behaviour questions and establishment of rapport with respondents; with previous field work experience were used. A structured questionnaire was designed and pre-tested in the nearby village, and changes were made to accommodate local terms when necessary to help in understanding of the questions by participants during the survey.

Using a structured questionnaire, a face to face interview was conducted. The questionnaire was administered in the Swahili language, and all the interviews were held in a temporary survey centre established in the village to maximize privacy and ascertain confidentiality.

The questionnaire collected information on demographic characteristics (age, sex, education level, marital status). Information's on condom use (ever versus never and if

ever, whether regularly and possible place to obtain a condom) and number of sexual partners in the past 4 weeks, 12 months were collected. Further information's regarding having sex during travel and participant's opinion on whether they consider themselves changed behaviour was also collected.

These are among the indicators that ware used to assess the extent to which sexual behaviour had changed during follow up.

Straight and reversed questions on various ways of HIV transmission were used to avoid acquiescence response ("yes saying").

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6.4.4: Assurance of data quality/quality control of the tests.

Daily checking of the questionnaire for missing, illogical and inconsistence data were done and corrections made before leaving the field area. Field team meetings were done frequently to discuss any emerging problems in the field. Collection of samples were done by experienced laboratory technician and transported under ideal condition for processing and testing.

The tests were done at the Clinical and Research laboratory at KCMC, a northern zone referral hospital. University of Bergen, Norway, organized by The Centre for International Health, did quality control of the HIV testing of 364 sera (11.2% of the total sample) and found excellent agreements with the test performed at KCMC.

6.5: Research and Ethical Issues:

The two survey rounds done under the Kahe cohort project were reviewed and cleared by the Ethical Clearance Committee of the Tanzanian Ministry of Health, the Muhimbili University College of health Sciences, Tanzania and the Norwegian Committee for Medical Research Ethics in Norway.

Permission's were also sought from the Moshi rural districts officials and village government of Oria, Kahe ward.

Oral Informed consent was obtained from each participant before any interview or HIV testing. Parents gave consent on behalf of children aged =14. Participants were informed that they may refuse to answer any question during interviews or withdraw from the study at any stage.

Before HIV testing, all participants received pre-test counselling, and those who came back to receive their results were informed by trained counsellors. HIV positive participants received medical follow-up during the entire period of the fieldwork and later referred to KCMC hospital for more care and support.

Free treatments of all curable diseases were offered to all participants and their families during the period of both surveys and individual health education regarding HIV/AIDS was given. Condoms were also freely distributed.

6.6: Confidentiality.

All interviews, examination and sample collection were done in a confidential place/room and code numbers were used in various tests. All information and test results were handled with great confidentiality.

6.7: Data analysis.

Statistical package for social sciences (SPSS version 11 for windows SPSS, IL, USA) was used for all analysis. Difference between proportions were assessed using $?^2$ test and fisher's exact test when appropriate and student t-test was performed for continues variables.

All p-value presented are two tailed. For risk factors, Relative Risk (RR) with 95% confidence interval was calculated.

For each survey round, age and sex specific prevalence's were derived from the numbers of participants testing positive and negative at that round. Those who were HIV negative in 1991 and had a definitive HIV test in the follow up phase (1993) were eligible for inclusion in the incidence analysis. Person-years (PY) at risk for incidence commenced at the recruitment phase when HIV negative individuals first gave blood and ceased at the date of their follow-up blood sample. The date of seroconvention were estimated as midway between the date of the last negative and the first positive HIV result

7.0: RESULTS

7.1: *Participation.*

In the recruitment survey in 1991, a total of 1558 men and 1681 women attended yielding the response rates of 82.9% and 84.3% respectively. During the follow up phase in 1993, 1006 men and 1185 women attended with consequent response rates of 76.9% and 76.9% respectively.

In all survey rounds, attendance was better among women than men but the age composition did not differ between participants and non-participants. *(Table 2)*

Out of 3239 individuals recruited in 1991, 1242 were seen again in 1993 giving an overall 38.3% re-attendance. There was no significant difference in attendance between males and females. The main reasons for non re-attendance were short-term absence (71%), migration (28%) and death (1%).

Table 2: Eligible population, attendance and re-attendance in the two whole village surveys, northeast, Tanzania

	1991		1993		Re-attendance	
	F	M	F	M	F	M
Eligible (N)	1994	1870	1541	1308	1681	1558
Mean age ± SD	23.2±19.2	23.2±20.1	23.5±17.5	22.8±20.6	23±19.2	22.5±20.4
Participants (n)	1681	1558	1185	1006	655	587
Particip. Rate	84.3%	82.9%	76.9%	76.9%	38.9%	37.7%
Mean age ± SD	23.1±19.0	23.5±20.1	23.06±17.8	23.5±20.7	23.9±18.8	24.5±21.4

N-listed as resident with an address in the area, SD-standard deviation, Mean age in years.

For genital examination in females, participants were significantly older than non-participants in both surveys. In 1991, mean age for participants was 29.1 compared to 24.1 for non-participants (CI for age difference: 2.7-5.6) while in 1993 the mean age was 27.6 compared to 24.4 for non-participants (CI for age difference: 2.3-5.8). *(Table 3).*

In both surveys, female non-participants were younger and had lower HIV-1 prevalence compared to participants. (2.5%; CI: 0.5-4.5 vs. 5.3%; CI: 3.1-7.5) for 1991 and 1.9%;

CI: 0.2- 4.3 vs. 4.1%; CI: 2.8-8.1 for 1993). Among the reported reasons for non-participation in women was being virgins, having periods and being pregnant.
Males were more likely to accept genital examination than women in 1991. Although male participants in the genital examination were also slightly older than non-participants in both surveys (non significant difference), the rate of HIV-1 infection did not differ between male participants and non-participants.

Table 3: Participation in genital examination and interviews among participants ages 15-44 years by sex and survey round.

	1991		1993	
	F	M	F	M
Genital examination				
Eligible (N_1)	635	518	492	316
Participants (n_1)	399	466	389	249
Mean age± SD	29.1±7.4	25.9±8.6	27.6±8.3	26.4±8.2
Parti. Rate- genital examination	62.8%	90.0%	79.0%	78.8%
Interviews				
Eligible (N_2)	651	516	493	318
Participants (n_2)	636	512	492	316
Response rate	97.7%	99.2%	99.8%	99.4%
Mean age± SD	27.0±8.58	25.8±8.86	27.6±8.4	26.2±8.6
% Sexually active	86.0%	91.9%	91.0%	88.0%

n_1, n_2- number of participants aged 15-44 years, SD-standard deviation, Mean age in years.

Interviews

In the 1991 survey, 512(99.2%) men and 636(97.7%) women aged 15-44 were interviewed regarding HIV/AIDS. Among those interviewed, 470 (91.9%) men and 547 (86.0%) women were sexually active. *(Table 3).*

During the 1993 follow-up survey, 316(99.4%) men and 492(99.8%) women aged between 15 to 44 years were again interviewed regarding HIV/AIDS. Four hundred and

six (91%) of the interviewed women and 277 (88%) of men were reportedly sexually active. In both 1991 and 1993 surveys, women interviewed were significantly older than men (p=0.03 for 1991, and p= 0.02 for 1993).

7.2: HIV-1/RTI/STI

HIV-1 prevalence.

The HIV prevalence in the total population was (42/3163) 1.3% and (37/2022) 1.8% in 1991 and 1993 respectively.

Although the prevalence increased in the follow-up phase, the difference was not statistically significant. (p=0.17).

Table 4: Prevalence of HIV-1 by age, sex and survey round.

	1991		1993		
	N	%HIV-positive	N	%HIV-positive	P-Value*
Men					
0-14	750	0.0	432	0.0	1.00
15-24	263	0.4	157	0.0	1.00
25-34	124	3.2	101	3.0	0.91
35-44	110	2.7	59	1.0	0.50
=45	262	0.8	194	3.0	0.42
Total(M)	1558	0.6	1006	0.7	0.87
Women					
0-14	729	0.1	451	0.0	1.00
15-24	271	3.7	201	8.0	0.87
25-34	203	6.9	158	14.0	0.49
35-44	153	2.0	124	3.0	0.79
=45	285	1.4	182	5.0	0.24
Total(F)	1681	1.9	1185	2.5	0.26
Total (M+F)	3163	**1.3**	2022	**1.8**	**0.17**

*P-value from $?^2$ test

Table 4 presents HIV prevalence rates by age, sex and survey.

In both surveys, women had significantly higher prevalence of HIV-1 than men (p=0.002 for 1991 and p=0.001 for 1993). Women had a high prevalence of HIV-1 infection at an early age (15-24) picking up at age 25-34. For men HIV-1 infections started later at age 24-34.

The age group 25-34 had the highest baseline and increased HIV prevalence for both sexes in both surveys. However, the increase in age group 25-34 was not statistically significant. Regarding marital status and HIV infections, the prevalence of HIV-1 in single participants in 1991 was 3.5% and that of married participants was 3.3% (no significant difference) while for 1993, single participant had a prevalence of 1.7% while that of married participants was 5.1% (p=0.05).

HIV-1 incidence.

Of the 3197 individuals who were HIV negative at recruitment, 1242 (38.9%) were followed up from 1992 to 1993 (2 years) and generated 2484 Person-Years at Risk (PYAR) during which time 22 (17 females and 5 men) seroconverted.

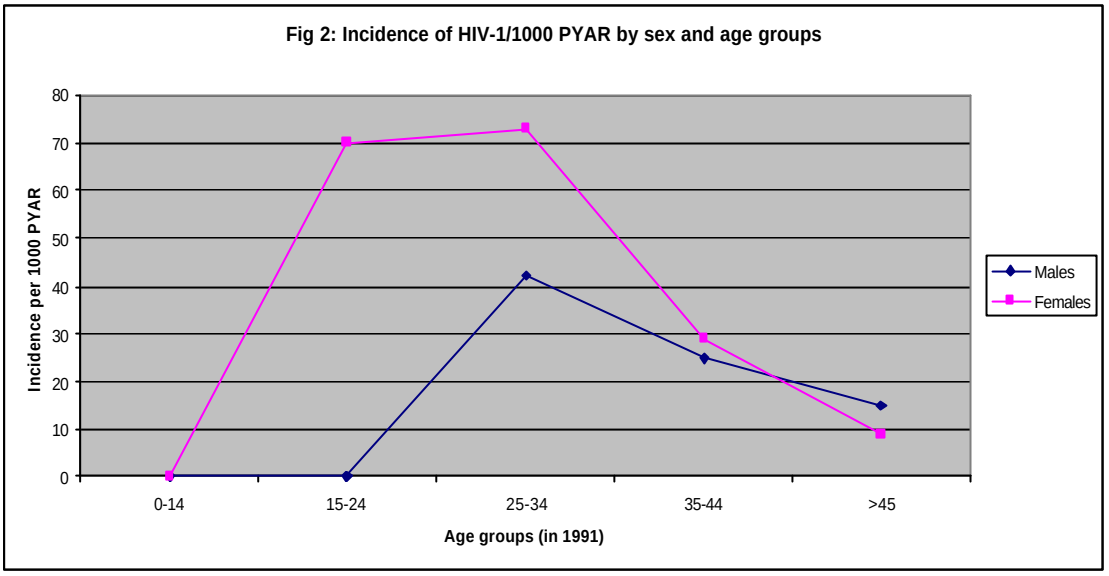
Thus, the overall HIV-1 incidence was 8.9/1000 PYAR [95% confidence interval (CI) 5.57-13.4].

Among the 655 female participants who contributed 1310 PYAR, there was 17 HIV-1 seroconverters giving an incidence of 13.0/1000 PYAR.

A total of 587 males participants were observed for 1174 PYAR during which 5 seroconverted, with a subsequent incidence of 4.3/1000 PYAR. *(Fig 2)*

Female participants had a higher risk of acquiring HIV-1 infection with a RR of 3.0 (95% CI; 1.12-8.16), p=0.02 compared to men.

One thousands and sixty eight (1068) single individuals were followed up for 2 years accumulating 2136 PYAR and 15 of them seroconverted. The incidence among the single participants was then 7.0/1000 PYAR. Of the 174 married participants who were followed for 2 years, 7 seroconverted and 348 PYAR were contributed. The incidence among the married was 20.1/1000 PYAR. The rate of HIV infections was 2.8 times among married than among single participants. RR=2.8(95%CI: 1.16-6.89, p=0.01).



RTI/STI.

Prevalence's of RTI/STI's by sex and survey round are presented in *Table 5.* There was a significant increase in the prevalence's of gonorrhoea, BV and *candidiasis* between 1991 and 1993 in both males and females. The highest increase in prevalence was gonorrhoea (4.3%) among men and in women BV (18.2%) and candidiasis (18.8%). The prevalence of other STI's namely *T. Vaginalis* vaginitis and *C .trachomatis* decreased during the survey periods in this population.

Table 5: Prevalence of RTI/STI's by sex and survey round.

RTI/STI	1991				1993				
	M	F	(N)		M	F	(N)		
	%	%		Total %	%	%		Total %	p= value* for total %
C.Trachmatis	9.6	6.9	(763)	8.3	2.2	4.0	(567)	3.3 ?	0.00
Gonorrhoea	0.4	0.8	(787)	0.6	4.3	3.6	(569)	3.9?	0.00
Active syphilis	1.3	3.8	(1720)	2.4	1.9	2.2	(1674)	2.1	0.67
§T.vaginalis		24.7	(359)	24.7		19.1	(302)	19.1?	0.13
§BV		3.3	(361)	3.3		18.2	(303)	18.2 ?	0.00
§Vaginal Candid.		4.5	(360)	4.5		18.8	(306)	18.8 ?	0.00

% = prevalence, Total *%* = Total prevalence for both males (M) and females (F) in each survey, BV = bacterial vaginosis. §Tested only in women ,*P-value from?^{2} test

In 1991, been treated for genital ulcer or genital discharge was associated with four times the risk of HIV-1 infections whilst those individuals who had a history of been treated for Tuberculosis or shingles had six fold increased risk for HIV-1 infections ($p<0.05$). *(Table 6)*

Although the risk of HIV-1 infections was twice among those individuals with bacterial vaginosis, this was however not statistically significant (P=0.5). The risk for HIV-1 infections was twice among those participants reported to have more than two sexual partners in the past 5 years. Nevertheless, this relationship did not attain statistical significance at 5% level. (p=0.2). Even though most of the STI's did not attain any significant relationship with HIV-1 in 1991,*(Table 7)* this was not the case in 1993 survey.

Table 6: HIV-1 risk factors by socio-demographic, sexual behaviour and health related factors in 1991 total village survey, northeast, Tanzania.

Variable	HIV+/Total	%HIV+	Crude OR(95% CI)	Adjusted OR[#] (95%CI)	p-value
Age(years)					
0-14	1/1478	0.1	1	1	
15-24	11/524	2.1	30.7(3.9-23.7)	0.07(0.0-0.8)	0.06
25-34	18/313	5.4	84.3(11.3-628.9)	0.2(0.2-2.6)	0.23
35-44	6/260	2.3	33.8(4.1-280.0)	0.1(0.0-1.2)	0.18
>44	6/543	1.1	16.2(1.9-133.8)	38.0(0.0-370.0)	0.84
Marital status					
Married	19/558	3.3	1	1	
Single	19/518	3.5	0.9(0.5-1.8)	0.6(0.3-1.2)	0.29
Religion					
Christian	20/541	3.6	1	1	
Muslim	16/524	3.0	0.8(0.4-1.6)	0.9(0.4-1.7)	0.76
Sexual partners in past 12 months					
0-1	25/684	3.5	1	1	
2-4	7/222	3.1	0.8(0.3-2.0)	1.2(0.5-2.9)	
>4	3/175	1.7	0.4(0.1-1.5)	0.5(0.1-1.8)	0.32
Sexual partners in the past 5 years.					
0-1	16/477	3.2	1	1	
2-4	14/313	4.3	1.3(0.6-2.7)	1.7(0.7-4.1)	
>4	5/291	1.7	0.5(0.2-1.4)	1.8(0.7-4.7)	0.21
Ever used condom.					
No	16/360	4.3	1	1	
Yes	9/186	4.4	1.1(0.5-2.5)	1.4(0.6-3.3)	0.45
Regularly used condom					
No	4/86	4.4	1	1	
Yes	6/100	4.6	1.2(0.3-4.3)	1.9(0.5-7.6)	0.42
Ever treated for genital discharge					
No	33/1473	2.2	1	1	
Yes	8/164	4.7	2.1(0.9-4.7)	3.5(1.3-10.0)	***0.01***
Ever treated for genital ulcer					
No	36/1560	2.3	1	1	
Yes	3/46	6.1	1.8(0.84-9.5)	4.4(1.2-16.0)	***0.03***
Ever treated for shingles					
No	37/2980	1.2	1	1	
Yes	5/72	6.5	5.6(2.1-14.0)	6.1(8.0-20.0)	***0.00***
Ever treated for TB					
No	39/3030	1.3	1	1	
Yes	3/47	6.0	4.9(1.4-16.6)	6.5(1.7-24.0)	***0.05***

[#] Adjusted for sex, age and marital status. The denominator varies due to missing data.

Table 7: Association between RTI/STI's and HIV-1 infections in 1991 total village survey, northeast, Tanzania.

	HIV+		HIV-		Crude	Adjusted	
		(%)		(%)	OR(95%CI)	OR[#] (95% CI)	p-value
Active Syphilis	1/34	(2.9)	23/1686	(1.4)	2.1(0.3-16.4)	1.2(0.2-9.4)	0.89
[§]*T .Vaginalis*	6/15	(40.0)	66/262	(25.2)	1.2(0.47-3.3)	1.1(0.4-3.0)	0.82
C. Trachomatis	3/22	(13.6)	64/741	(8.6)	1.5(0.4-5.2)	1.6(0.5-5.8)	0.43
[§]*B. Vaginosis*	2/18	(11.1)	11/345	(3.2)	3.39(0.7-16.4)	2.0(0.2-17.4)	0.5 7
N.gonorrhoea	0/26	(0.0)	4/761	(0.5)	0.02(0.0-87.0)	0.01(0.0-12.0)	0.84
[§]Candidiasis	0/21	(0.0)	16/349	(4.6)	0.01(0.0-16.0)	0.01(0.0-16.0)	0.72

[#] Adjusted for sex, age and marital status. Total numbers of participants in genital examination for denominator are shown in *Table 3*. [§]**T**ested only in women. The denominator varies due to missing data.

A six times risk of acquiring HIV-1 was associated with having active syphilis (p=0.03) in 1993. *(Table 8)* The risk of HIV-1 infection in the same survey increased almost three times in participants found to have T. *Vaginalis*.

Table 8: Association between RTI/STI's and HIV-1 infections in 1993 total village survey, northeast, Tanzania.

	HIV+		HIV-		Crude	Adjusted	
		(%)		(%)	OR(95%CI)	OR[#] (95% CI)	p-value
Active Syphilis	2/29	(6.9)	30/1645	(1.8)	3.7(0.8-16.5)	6.2(1.2-32.0)	***0.03***
[§]*T.Vaginalis*	8/14	(57.1)	67/288	(23.3)	2.5(1.0-6.3)	2.7(1.1-6.8)	***0.03***
C. Trachomatis	1/22	(4.5)	18/545	(3.3)	1.4(0.2-10.8)	1.6(0.47-5.8)	0.44
[§]*B. Vaginosis*	3/19	(15.8)	64/284	(22.5)	0.7(0.2-2.4)	0.7(0.2-2.4)	0.67
N.gonorrhoea	1/21	(4.7)	20/508	(3.9)	1.2(0.2-9.4)	1.3(0.2-10.0)	0.82
[§]Candidiasis	4/18	(22.2)	67/288	(23.3)	0.9(0.3 -2.9)	0.9(0.3-3.0)	0.98

[#] Adjusted for sex, age and marital status. Total numbers of participants in genital examination for denominator are shown in *Table 3*. [§]**T**ested only in women. The denominator varies due to missing data.

Furthermore, despite that significant association was not found, been treated for genital ulcer or tuberculosis or having current *C. Trachomatis* infection was associated with twice the risk of acquiring HIV-1 infections in 1993. *(Table 8, 9).*

Table 9: HIV-1 risk factors by socio-demographic, sexual behaviour and health related factors in 1993 total village survey, northeast, Tanzania.

Variable	HIV+/Total	%HIV+	Crude OR(95% CI)	Adjusted OR[#] (95%CI)	p-value
Age(years)					
0-14	0/883	0.0	1	1	
15-24	8/350	2.2	45(0.0-28.0)	2.3(0.8-5.8)	0.82
25-34	17/242	6.6	14(0.0-87.0)	2.0(0.8-6.2)	0.77
35-44	4/179	2.2	44(0.0-28.0)	0.7(0.2-2.4)	0.23
>44	8/368	4.1	43(0.0-27.0)	0.8(0.0-2.7)	0.75
Marital status					
Married	14/292	5.1	1	1	
Single	9/443	1.7	3.2(1.2-8.3)	2.7(0.9-8.0)	0.71
Religion					
Christian	12/405	2.9	1	1	
Muslim	14/345	3.9	1.4(0.6-3.0)	1.3(0.6-2.9)	0.59
Sexual partners in past 12 months					
0-1	2/512	3.9	1	1	
2-4	6/134	4.3	1.1(0.4-2.7)	1.7(0.6-4.4)	
>4	2/41	4.7	1.2(0.27-5.25)	1.0(0.2-5.6)	0.97
Sexual partners in the past 5 years.					
0-1	14/370	3.6	1	1	
2-4	13/247	5.0	1.4(0.6-30.0)	2.2(0.9-4.9)	
>4	2/70	2.8	0.7(0.16-3.3)	0.9(0.2-4.8)	0.55
Ever used condom					
No	19/371	4.9	1	1	
Yes	6/203	2.9	0.57(0.2-1.4)	0.9(0.3-2.2)	0.73
Regularly used condom					
No	6/95	5.9	1	1	
Yes	3/137	2.1	0.3(0.1-1.4)	0.7(0.2-3.3)	0.68
Ever treated for genital discharge					
No	35/995	3.1	1	1	
Yes	2/37	5.1	1.7(0.4-7.2)	1.9(0.4-8.8)	0.42
Ever treated for genital ulcer					
No	29/672	4.1	1	1	
Yes	0/6	0.0	0.02(0.0-9.5)	0.3(0.0-71.0)	0.81
Ever treated for shingles					
No	37/2003	1.8	1	1	
Yes	0/16	0.0	0.0(0.0-11.0)	0.0(0.0-15.0)	0.78
Ever treated for TB					
No	36/1975	1.8	1	1	
Yes	3/47	2.2	1.2(0.16-9.2)	1.5(0.2-12.1)	0.74

[#] Adjusted for sex, age and marital status. The denominator varies due to missing data.

7.3: HIV/AIDS related Knowledge and risk perception

In both surveys, nearly all respondents (98%) had heard of HIV/AIDS and knew about the sexual transmission of HIV. *(Table 10)*

The proportion of respondents who knew someone with HIV/AIDS increased substantially in the follow up survey. Although in the baseline survey, more men than females knew that a person may be infected with HIV and still live without symptoms, there was a significant increase in the proportion of females in this category from 1991 to 1993 (p=0.000).

When participants were asked whether a HIV infected, but healthy looking individual can transmit HIV, the proportion of men who agreed to that stood high in both surveys but female's proportion increased significantly (p=0.03) in the follow up survey. The majority of participants (90%) perceived themselves to be at risk of acquiring HIV/AIDS and reported to have changed behaviour in both survey rounds.

7.4: Self reported risk sexual behaviour.

During the 1991 survey in 4^{th} weeks and 12^{th} month recall, a large proportion of single men and women in this population were more likely to report having multiple sexual partners (=2) than those who were married. This pattern was reversed in the follow up round in 1993 where more married men and women reported to have engaged in multiple sexual liaisons than those who were single. *(Table 11)*

Table 10: Risk perception and HIV/AIDS related knowledge by sex and survey rounds among 15-44 years.

	1991	1993	p-value*
Respondents;			
Men:	512	316	
Women:	636	492	
Heard about HIV/AIDS (%)			
Men	99.6	99.4	0.97
Women	99.5	90.0	0.28
Knows HIV can be transmitted sexually (%)			
Men	97.8	97.4	0.96
Women	97.3	98.6	0.88
Knows someone with HIV/AIDS (%)			
Men	17.6	37.3	0.00
Women	13.3	31.8	0.00
Knows an infected person can live without symptoms (%)			
Men	69.3	62.3	0.39
Women	35.3	57.3	0.00
Knows a health looking person can transmit HIV (%)			
Men	93.3	95.8	0.81
Women	65.5	81.6	0.03
Perceive him/herself at risk and have changed behaviour (%);			
Men	96.8	94.0	0.79
Women	88.0	98.6	0.69
Age of sexual debut.(median in years)[a]			
Men	16	17	0.99
Women	18	18	1.00

*P-value from $?^2$ test

Table 11: Reported number of sexual partners by sex, marital status and survey.

	1991	1993	p-value*
No. of respondents;			
Male:	512	316	
Female:	636	492	
No. of partners in the past 4 weeks (%)			
Men:			
Married.			
1	*84.1*	*55.5*	*0.56*
2-4	12.9	17.9	0.87
>4	4.0	5.5	0.99
Single.			
0	45.7	9.5	0.00
1	37.1	75.9	0.00
2-4	13.4	11.3	0.84
>4	2.6	0	0.00
Women:			
Married.			
1	97.6	92.4	0.32
2-4	2.1	5.4	0.00
>4	0.3	1.1	0.05
Single.			
0	60.5	22.6	0.00
1	34.6	73.7	0.00
2-4	4.3	2.1	0.00
>4	0.0	0.4	0.45
No. of partners in the past 12 months (%).			
Men.			
Married.			
1	63.0	46.1	0.09
2-4	30.2	31.3	0.83
>4	6.5	12.4	0.06
Single.			
0	9.4	2.8	0.02
1	32.6	62.4	0.00
2-4	39.4	30.5	0.20
>4	18.1	3.5	0.00
Women.			
Married.			
1	92.2	82.8	0.53
2-4	7.6	13.0	0.14
>4	0.3	3.2	0.03
Single.			
0	18.5	4.3	0.00
1	58.0	82.6	0.02
2-4	27.2	12.2	0.02
>4	0.6	0.6	1.00

*P-value from $?^2$ test

In both 4th weeks and 12th month recall, there was a significant increase in proportion of single men and women reporting to have only one partner in this population. This was coupled by a significant decrease in the proportion of single men and women having more or equal than 2 (=2) sexual partners. (p= 0.00 for both surveys and recall time) Based on the 4 weeks recall in 1991, 82 (16%) of men and 22 (3.4%) of women (p=0.000) were practising high risk sexual behaviour; while in 1993, 52(16.4%) of men and 20 (4%) of women (p=0.000) involved themselves in multiple sexual liaisons. When participants were asked to recall their sexual partners in the past 12 months, 206 (40.3%) of men and 112 (17.6%) of women (p=0.000) were practising risk sexual behaviour in 1991, and in the follow up survey in 1993, 121 (38.2%) of men and 71(14.5%) of women (p=0.000) practised risk sexual behaviour.

The proportion of married participants with one sexual partner decreased across the surveys while this proportion increased among single participants.

In overall, more men reported to have more multiple sexual partners than women and while single participants moved towards safer sex, practise of risk sexual behaviours increased among married participants.

There was an increase in the proportion of men and women using condom, (ever and regular) in our population though most of the increase was not statistically significant. *(Table 12)*

During both survey rounds, a substantial proportion of men than women reported to have involved themselves in casual sex during travel.

Table 12: Reported condom use and sex during travel by sex, marital status and survey round.

	1991	1993	p-value*
Respondents.			
Ever used (n1)	199	211	
Regular use (n2)	125	142	
Condom use [a]: (%)			
Men:			
Married.			
Ever.	32	54	0.02
Regular [b]	65	82	0.44
Single.			
Ever	44	46	0.82
Regular	66	69	0.86
Women:			
Married.			
Ever	22	36	0.09
Regular	39	50	0.54
Single.			
Ever.	21	33	0.12
Regular	33	46	0.46
Sex during travel (%)			
Men	6.8	6.6	0.99
Women	2.2	1.1	0.13

[a] From those who reported to be sexually active, [b] from those who have ever used condom (n1). *P-value from $?^2$ test.

7.5: Travelling and HIV-1 infection.

During both surveys in 1991 and 1993, a significant proportion of women than men (61% vs.43%, p= 0.008 for 1991, 70% vs. 49%, p=0.000 for 1993) reported to have travelled within the region, while a significant proportion of men than women (34% vs. 17%, p=0.000 for 1991, 40% vs. 27%, p= 0.000 for 1993) reported to have travelled outside the region.

Univariate analysis showed that, prevalence of HIV infection did not differ between travellers and non-travellers in both 1991 and 1993 surveys. When the analysis was done separately for males and females, well as for type of travel (within or outside the region), women who travelled had higher prevalence of HIV-1 than those who did not travel. However, this difference was not statistically significant at 5% level. *(Table 13)*

Table 13: Prevalence of HIV-1 by sex, travel status and survey round.

	1991			1993		
	%-trv	%-nontrv	*p-value*	%-trv	%-nontrv	*p-value**
Travel within the region						
Men	1.4	1.8	=1.00	0.7	1.9	=0.62
Women	4.9	3.7	=0.50	6.0	3.4	=0.25
Travel outside the region						
Men	1.8	1.5	= 1.00	0.8	1.6	=1.00
Women	6.0	3.4	= 0.23	7.6	4.3	=0.14

%-trv = percentage among travellers, %-nontrv = percentage among non travellers. *P-Value from $?^2$ test

8.0: Discussion.

8.1: Main discussion

The whole village population was invited to participate in both survey rounds. High overall response rates were achieved and efforts were made to involve even the most mobile population securing that this findings probably were representative of this whole population. However, the cohort follow-up rate was low in this study; hence the incidence reported should be interpreted with caution.

In the genital examinations in 1991 survey, nearly one third of the women refused genital examination and these were significantly younger and had significantly lower HIV prevalence than those who agreed for genital examination. As most of those who refused the examination claimed to be virgin, these findings were expected. This supports the idea that, it was not the most at risk women who did not participate, therefore this HIV/STI findings are probably representative of the sexually active group.
Participation in genital examination in 1993 was relatively better though like in 1991, non-participants had lower HIV-1 prevalence than participants. Males were more likely to participate in the examination than women in both surveys.

Regarding the behavioural data consistent questions were used in both surveys enabling comparison of behavioural factors over time to elicit behavioural change.

This study showed that, the overall prevalence of HIV-1 infection in this rural population increased from 1.3% to 1.8% with an overall incidence of 8.9/1000 PYAR. The increase in prevalence confirms the findings from the national sentinel surveillance system[1] and some population based studies around the country.[3]
This incidence findings are in line with those from a study in Mwanza[3] involving general population which reported an incidence of 11/1000 PYAR. However, the incidence in this study was lower than that of a study involving police officers in Dar es Salaam [5] reporting an incidence of 19.9/1000PYAR. The high prevalence in the police officers study could be explained by the fact that police officers are considered high risk group due to their high mobility.
Together with the above studies,[3, 5] a cohort study involving factory workers in Tanzania [6] revealed a higher incidence in women than men 10/1000PYAR vs. 19/1000PYAR.

Those findings resemble the findings in this study where the rate of acquiring HIV-1 infections was three times higher in women than men.

As incidence data's represent the most effective direct measure of whether the infection is increasing or abating in a given population, these findings suggest that HIV infection is at increase in this rural population.

Although the overall HIV prevalence in this general population was much lower than that from the other urban studies [5, 6, 12-14] and those involving special groups in other part of the country, the high incidence indicates that the rate of infection was very high in this rural population.

The rate of HIV infections in women was alarmingly high, affecting younger women and this was similar to other studies within and outside the country [9-11, 14, 18-22]

This pattern of HIV spread with women been infected at an early age than men have been showed in most of the African population calling more intervention to be targeted to women at an early age as they are at the most risk of HIV infections.

While single individuals moved towards safer sex, married individuals reported to have more sexual partners between surveys. Married participants in this study had high prevalence and incidence of HIV-1 infections than single participants. This is coupled by an increase in the practice of risk sexual behaviours among the married. In addition, the proportion of married individuals reporting one sexual partner decreased while this proportion increased among single participants. These findings are confirmed by the resent national surveillance system report [2] which revealed that, of all AIDS cases diagnosed from health facilities in the country in the year 2001, 47% were of married people and a year later in 2002, the proportion increased to 56%. However single individuals had large overall prevalence than married individuals in the national population due to their previous high rates during the early periods of the epidemic. It's also worthwhile, noting that our prevalence and incidence were not adjusted for age and this could have overestimated the reported findings.

More men and women in this population have been found to involve themselves in casual sex during travel. Although we did not find any difference in HIV-1 infection between travellers and non-travellers, probably due to few number of HIV cases, travellers could be contributing to the spread of HIV-1 infection among their married

partners in the village. This could be truer for men who had more casual sex and high prevalence of highly infective gonorrhoea. These men may be acting as a core "bridging" group bringing STI's including HIV to their families in the village.

From 1991 to 1993, the prevalence's of gonorrhoea, BV and candidiasis increased significantly in this population. The most prevalent STI's in this rural population was *T. vaginalis, C.trachomatis,* bacterial vaginosis and candidiasis (*Candida albicans*). This spectrum of prevalent STI's is substantiated by other studies [13, 19, 20] done in the same area. The prevalence of BV in this community was low compared to what has been reported from other studies in the region [13,19, 20]
However, those studies have been facility based and/or involving high risk groups hence there reported high prevalence could be due to selection bias. We still believe that our result of overall BV prevalence of 18.2% in 1993 is representative of the general population in this region.

Epidemiological and biological studies have described the role of both ulcerative and non-ulcerative STI's in HIV-1 transmission. [52-61.] While ulcerative STI's causes obvious disruption of the mucosa which acts as entry port for HIV-1, no-ulcerative STI's causes some degree of inflammation which increases HIV-1 target cells in the genital mucosa. Chlamydia trachomatis have been found to enhance HIV-1 replication in the presence of polymorphonuclear cells. Lack of lactobacilli in bacterial vaginosis reduces the concentration of the natural microbicide hydrogen peroxide, affect the low pH which is important for CD^4 lymphocytes activation and stimulates lymphocytes and alter the effectiveness of the genital mucosal immune system. [50, 59, 60]

In the same way as other studies, [12-14, 19, 20, 45] non-ulcerative STI's are more prevalent than ulcerative one's; therefore in a population where heterosexual relationship is the major way of HIV-1 transmission, the magnitude HIV-1 attributed to these infections could be high. This rural population had a substantially high magnitude of STI's despite the fact that we did not test for *T. vaginalis* in men; therefore the increase in the prevalence of STI's in this population could partly explain the observed high rate of HIV-1 infections especially in women. Apart from the high rate of risk sexual behaviour in this rural population which could explain the high prevalent state of STI's, poor accessibility to health services could also fit in to the equation.

A substantial increase in the knowledge and awareness was observed among women from 1991 to 1993. The high knowledge in both men and women in the 1993 survey could partly be a result of the health education intervention offered to all participants during VCT in the 1991 survey round. Most health education interventions aiming at preventing HIV/AIDS have focused on raising general awareness based on the premise that the likelihood of behavioural change is directly related to the level of knowledge. This assumption has been shown to be inadequate to account for the complex relationship between knowledge and behavioural change[23].

It has been postulated that [64], behavioural change is a gradual process. It needs enough knowledge which should accumulate for attitude to be initiated. Then attitude accumulates to initiate behavioural change. Considering knowledge as an intervention, and the fact that it was introduced only a year before the 1993 follow up, more time may be needed to realise its significant impact on behavioural change.

According to a simple social learning theory[65] model the likelihood that a person will change behaviour is directly related to a number of variables namely; risk perception, preference to condom use and abstinence or one faithful partner; behavioural capability (Knowledge and skills); self-efficacy (perceived self-confidence to use condom, abstinence or one faithful partners. As adequate knowledge and risk perception was observed in this population, self-confidence and skills which need time may be lacking in individuals cognitive process to induce behavioural change. More knowledge enhancing activities and condom availability are necessary to potentiate self-efficacy.

Therefore in our study, substantial proportion of men and women continued to practice high risk sexual behaviours including casual sex during travel regardless of the increase in HIV/AIDS knowledge and awareness.

In this study as observed in the Tanzania Demographic Health survey (TDHS)[30] 1991/1992/1996, men were significantly more likely to report multiple sexual partners than women indicating that high-risk sexual behaviour could be more common in men than in women[24]. This is explained by the nature of sexuality in African societies where men control all economical and socio-cultural environments within which sexuality takes place in such a way that multiple sexual partners among men in these societies tend to be socially sanctioned. Various studies have shown that men play a big role in the spread of

STI/HIV infections and their sexual behaviour is a major determinant of HIV infection among women not engaging in risk-sexual behaviour.[25-27]

Most interventions have targeted single individuals with the inherent perception that married individuals engage in safer sex. This study highlights the importance designing interventions that targets/involve married individuals to facilitate adherence to safer sexual behaviour.

Condom use has been identified as one way of mitigating the spread of STI/HIV infection. In this rural population, the proportion of condom use among male increased from 1991 to 1993. This increase could be due to the fact that VCT, condom promotion and distribution was done during the 1991 survey round increasing awareness and accessibility giving such a high proportion comparing to the national survey proportion of 15.2% in 1996. As a shortcoming of many behavioural studies, social desirability could partly explain the reported high rate of condom use as the rate of STI's particularly gonorrhoea was found to be at increase among men in this population. Surprisingly but supportive to the above gonorrhoea findings, participants who reported ever/regular use of condom in 1991 had also high prevalence of HIV-1 than those reported not using. Therefore, despite a rise in reported condom use, it's possible that these condoms were not consistently used.

Studies from Uganda have described the importance of multiple sexual partners as a corner stone in HIV-1 transmission. Therefore, in an area where over 83% of infections[2] are acquired through heterosexual contact, an increase in the number of new HIV-1 infections mainly implies increase in risk behaviours.

8.1: Validity of data presented.

Sampling, participation and interviews

These surveys aimed at including everyone in the village; therefore random sampling was therefore not relevant. High response rates were archived in both surveys probably indicating that majority of the population were included hence making results presented representative of this village. Moreover, those few who did not participate did not differ in structure (age, sex) and HIV-1 infections with participants.

A low re-attendance rate (39%) was achieved in this study, but those who re-attended did not differ by sex and age with those who did not. Thus, the re-attended participants may be representing a random sample of this village population validating the reported incidence.

The problems of genital examination in women have been described earlier in part 7.1. One third of women aged 15-44 refused genital examination in 1991 survey, however; HIV-1 prevalence of those refused was lower than those underwent the examination. These findings were then expected because majority of those who refused mention being virgin as a reason.

Therefore, it was no the at risk women who withdrew from the genital examination. With regards to behavioural and knowledge data's, consistent questions using the same questionnaire was used in both surveys allowing comparison of findings between individuals and surveys.

Oria village represent a typical rural Tanzanian population as described in part 6.2 above. As 78% of the Tanzanians lives in rural areas like Oria, these findings most likely represented the Tanzanian's HIV/STI situation at the time of these surveys.

Validity of the tests.

Samples were collected by experienced laboratory technicians and transported under ideal conditions to be tested at a reputable referral hospital-Kilimanjaro Christian Medical Centre (KCMC). The study used standardised laboratory tests and the same tests and testing strategies were used in both survey rounds. All the tests were those recommended at the time of these surveys.

Furthermore, quality control of the tests was organised by The Centre for International Health of the University of Bergen where 11.2% of the samples were again tested. An excellent agreement was found with the tests performed at KCMC.

8.3: Study limitation.

Findings in this study should be interpreted in the light of the following limitations.

- Low rate of follow-up was archived which could limit the strength of reported incidence calculation as presented in the discussion. However, individuals who were followed up did not differ in structure with those who were not hence this low rate of follow-up may not have any impact in the validity of the results presented.
- Due to problems encountered in matching the individuals STI's data's, it was impossible to calculate incidence of various STI's. This study therefore failed to establish the causal relationship between HIV-1 and various STI's. Moreover, the number of HIV-1 cases in different STI's categories were also very few limiting various statistical calculations.
- Due to various reasons, *Trichomonas vaginalis* was not tested in men in both survey rounds. Hence, the STI's burden presented in this study may be an underestimation of the true burden of those infections in this rural village.

8.4: Conclusion and recommendations.

The overall rate of HIV-1 infection was at increase during the time of the survey in this population. The rate of HIV-1 infection in women was three (3) times higher than that of men and women were infected at lower age than men.

Married participants practiced more risk sexual behaviour than single participants and were found to have high rate of HIV-1 infections.

Gonnoccal infection has been at increase among adults and other STI's are still a public health problem particularly in women.

Knowledge regarding HIV/AIDS transmission and condom use increased in this population.

HIV-1 infection did not differ between travellers and non- travellers, though a large proportion of travelling men reported to have involved themselves in casual sex than women.

Practise of multiple sexual partners, casual sex during travel and increased magnitude of STI's are the main reasons that could explain the increased rate of HIV-1 infection in this rural population.

These findings indicate that the ongoing efforts to promote safer sexual practices should be targeted towards married individuals and travelling men in this community.

Due to the gradual nature of behavioural change, continues skills and individual self-efficacy enhancing activities may be needed to initiate more behavioural change.

As women are at most risk of STI's and HIV-1 infection, more innovative approaches are urgently needed to reach this vulnerable group.

8.5: Future perspectives.

This study offer critical baseline data's from this rural population in the beginning of the second decade of HIV-1 infection in the country. A new third decade follow-up study of the same village, linking up there data's will offer avenue to in details describe the dynamics of HIV/STI's and risk sexual behaviour during the past 13 years. The established cohort will be one of the oldest in the country and hence providing opportunity to examine various community copping mechanisms following the HIV-1 epidemic and its related demographic, socio-cultural and economic impacts.

The state of bacterial STI's have been explored in this fist phase, but viral STI's particularly HSV-2 which has been described as a major cause of genital ulcer in the world has not being studied in this village. As studies on HSV-2 from the surrounding communities [13, 52] have revealed high prevalence's; this infection could be potentiating HIV-1 infection in this village and warrant to be studied.

9.0: REFERENCES

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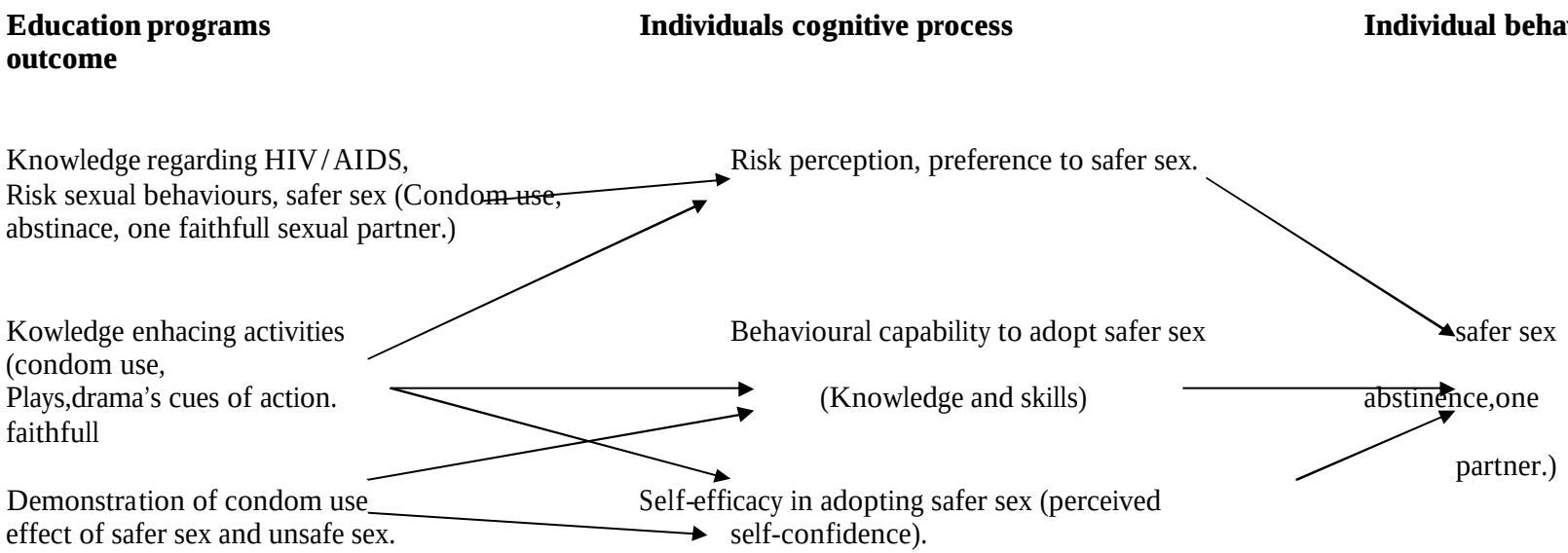
10.0: APPENDIX

10.1: Appendix I

Simple Social Learning Theory : Model for risk sexual behavioural change.



Source: **Baranowski.T**[64]

10.2: Appendix II

Kahe-Cohort Study Participation

STUDY PARTICIPATION STATUS

1. Respondent identification number _____

2. Sex of the respondent 1.Male

2. Female

3. How old is the respondent _____ years

(*probe for best estimate*)

4. Agrees to blood test for HIV: 1. Yes

2. No

5. Want to know results of HIV test: 1. Yes

2. No

RESULT CODES

6. HIV test completed (apply to all participants) 1. yes

2. No

7. KABP survey completed (apply to all participants age 15-44) 1. Yes

2. No

8. STD exam. Completed (apply to all participants age 15-44) 1. Yes

2. No

Respondent not attending place for interview/health examination

9. Not found on first visit

Reason: _____ (__)

10. Not found on second visit

Reason: _____ (__)

11. Not found on third visit

Reason: _____(__)

12. Respondent away for the duration of the survey

Reason: _____ (__)

13. Respondent refused; Why? (Optional): _____ (__)

14. Other: _____ (__)

15**. Name of interviewer: _____ 16. Date _____**

MUTAN/COHORT

1. Code no. _____ 2. Date:_____

3. Sex of respondent: 1. Male. 4. Age: _____
   2. Female.

5. What is your religion?
   1. Catholic-Christian.
   2. Protestant-Christian.
   3. Muslim.
   4. Other (Specify): _____.

6. What is the highest level of formal education you have completed?
   1. No formal education.
   2. Standard 1-4
   3. Standard 5-7
   4. Form 1-4
   5. Form 5-6
   6. Higher secondary school
   7. Other.

7. What is your present major occupation?
   1. Farmer/peasant
   2. Government employee
   3. Private business owner
   4. Private business employed
   5. Housewife
   6. Student (primary/sec. school)
   7. Unemployed
   8. Petty (small) business
   9. Others

8. What additional activities do you do to subsidize income?
   1. None
   2. Specify _____

9. What is your current marital status?

1. Single
2. Married
3. Cohabiting
4. Divorced/separated
5. Widow/widower

10. Are you in a polygamous marriage?

1. Yes, **(go to Ques 11)**
0. No, **(go to ques. 12)**

11. A: Male: How many wives do you have? _____

B: Female: How many wives does your husband have including yourself? _____

12. If married, do you live with your spouse(s)

1. Yes, all the time
2. Yes, one to four times a year
3. Yes, every month or after one month
4. Yes, So many times per month

13. If divorced, separated or widowed, how many years ago did this happen? _____years ago.

(Write 0 if less than 1 year)

14. How old were you when you first married? _____ Years old.
(or started cohabiting)?

15. How long have you lived in this village? _____

(If less than a year, write 00; if since birth write 98)

16. What is your tribe?

1. Chagga
2. Pare
3. Mkahe
4. Mkamba
5. Others

The next questions are about HIV/AIDS and other STI's. Please answer yes or no, or whether you don't know the answer to a question.

17. Can a person be infected and have the virus that causes AIDS but not have any symptoms?
    1. Yes
    0. No
    00. Don't know

18. Can someone who looks healthy but who has the AIDS virus pass it on to other people?
    1. Yes
    0. No
    00. Don't know

19. Can one get AIDS by touching the body of a person who has AIDS or AIDS virus?
    1. Yes
    0. No
    00. Don't know

20. Can one get AIDS by kissing a person who has AIDS or AIDS virus?
    1.Yes
    0. No
    00. Don't know

21. Can one get AIDS by sharing food or cups with a person who has AIDS or AIDS virus?
    1. Yes
    0. No
    00. Don't know

22. Can one get AIDS by having sex with someone who has AIDS or AIDS virus?
    1. Yes
    0. No
    00. Don't know

23. Can one get AIDS by being bitten by mosquito or other blood sucking insects?
    1. Yes
    0. No
    00. Don't know

24. Can one get AIDS by wearing clothes used by a person who has AIDS or AIDS virus?
    1. Yes
    0. No
    00. Don't know

25. Can one get AIDS by being cursed by another person?

1. Yes
0. No
00. Don't know

26. Can a woman who has AIDS pass it on her baby during pregnancy or at delivery?

1. Yes
0. No
00. Don't know

27. Do you think that a person who has AIDS or AIDS virus can be cured

1. Yes
0. No
00.Don't know

28. How much of a threat do you think HIV/AIDS is to the health of your local community?

1. No threat at all
2. Some threat
3. Serious threat
4. Don't know

29. Are you personally at risk of getting HIV/AIDS?

1. No, not at all
2. Yes, at slight risk
3. Yes, at serious risk
4. Don't know

30. Can you protect yourself against getting HIV/AIDS?

1. No, not at all
2. Yes, with difficult
3. Yes, I can easily protect myself
4. Don't know

I will now ask you some personal questions regarding sexual behaviour. Remember that your answers will be treated strictly confidential.

31. Have you ever had sexual intercourse in your lifetime? 1.Yes 0. No **(go to Q 36)**

32. How old were you when you had your first intercourse? _____ years.

33. How many different persons have you had sex within the last 4 weeks, including your spouse /regular partner? _____ Total no. of persons

34. Altogether, how many different persons, including your spouse/regular partner, have you had sex with in the last 12 months, that is since _____ number

35. How many different persons have you had sex within the last 5 years, including your spouse /regular partner? _____ number

36. Do you often travel within Kilimanjaro region
1. No
2. Yes, once to four times a year
3. Every month or after every one month
4. Few times a month
5. Others

37. Do you often travel outside the Kilimanjaro region?
1. No
2. Yes, once to four times a year
3. Every month or after every one month
4. Few times a month
5. Others

38. Do you usually have sex with people other than your spouse/regular partner during travel? 1. Yes 2. No

(For the condom questions: refer to <u>"your partner"</u> when interviewing women, but make sure that questions refer to when the interview object is having sex with her partners)

39. Do you know what a condom is?	1. Yes 0. No, explain what its and show one)
40 Do you know where you can get condom?	1. Yes 2. No
41. If yes, Where would you go to et condom?	1……. 2. …… 3. ……
42. Have you (or your partner) ever used condom during sex?	1. Yes 0. No **(go to Q 47)**
43. Do you (or your partner) use condom with your spouse /regular partner?	1. Yes, always 2. Yes most of the time 3. Yes, sometimes 4. No, never
44. Do you (or your partner) use condoms with other partner/regular partner?	1.Yes, always 2. Yes most of the time 3. Yes, sometimes 4. No, never
45. Do you use a condom regularly?	1. Yes 0. No
46. Have you changed your sexual behaviour to prevent yourself from contacting HIV/AIDS?	1. Yes 2. No

MEDICAL HISTORY

I am now going to ask you questions about your health.

Have you during the last 5 years ever treated for?

	No	*Yes*
47. Shingles (Herpes zoster)……	0	1
48. Tuberculosis……	0	1
49. Urinary infections…….	0	1
50. Abnormal genital discharge……	0	1
51. Genital ulcer…….	0	1
52. Genital warts ……..	0	1
53. Abscess in the groin…….	0	1

54. Have you during the past 5 years been treated for STI?

1. Yes, **(go to ques.55)**
0. No, **(go to ques.56)**

55. If yes, by whom? Specify:

1. Private practitioner
2. Non- government dispensary
3. Government dispensary
4. Non-government hospital
5. Government hospital
6. Traditional healer
7. Others, mention_____

During the last month, have you had?

	No	Yes
56. Mucous stool with abdominal cramps	0	1,
57. Prolonged fever, >1 month…….	0	1
58. Prolonged cough,>1 month……	0	1
59. Prolonged diarrhea, >1 month ……	0	1
60. Considerable weight loss……	0	1, Specify: _____
61. Pruritic dermatitis…….	0	1
62. Painful urination……..	0	1
63. Abnormal genital discharge……	0	1
64. Genital ulcer…….	0	1

65. Have you received antibiotics during
the last two weeks? No…..0 Yes…1, Specify _____

66. Name of medicine _____

67. Days since treatment ended _____days.

68. Other health complains, specify _____
_____

Genital examination

69. Genitalia external (men:penis, testicles, epidydimis, Female: Labia, clitoris,introitus) :

Normal …… 0
Discharge……..1 Specify _____
Ulcer……..2 Specify _____
Other ……3 Specify _____

70. Diagnosis: _____
71. Treatment: _____
72. Follow up:_____
73. Clinician Initials: _____

END OF QUESTIONNARE

THANK YOU FOR ANSWERING THESE QESTIONS

PROCEED WITH COUNSELLING AND AIDS HEALTH EDUCATION

74. How would you feel if you find that you are HIV positive?

_____

75. Do you have a relative whom you would like to share these results with? _____

LABORATORY RESULTS

BLOOD SAMPLE: No……..0

Yes…….1

2. HIV ……..

3. RPR …….

4. TPHA …….

WET PREP: No……0

Yes ……..1

2. Trichomonas……..

3. Candida ……

4. Clue cells ……

5. Leucocytes …….

GRAM STAIN: No…….0

Yes ……1

2. Cervix ……..

3. Vagina …….

4. Urethra ……

GC CULTURE: No……..0

Yes…….1

2. Cervix ……

3. Urethra …….

CHLAMYDIA ELISA: No……0

Yes…..1

2. Cervix……

3. Urethra ……..